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Before the Subcommittee on Oversight and Investigations and
the Subcommittee on Health and Environment,
Committee on Commerce
United States House of Representatives

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Chairmen and Distinguished Members of the Subcommittees: I am pleased to have this opportunity to testify at your request on scientific issues related to the revised National Ambient Air Quality Standard for Ozone that the U.S. Environmental Protection Agency proposes to promulgate under the legislative mandate of the Clean Air Act.

My educational background is in internal medicine (M.D., 1951) and environmental and occupational medicine (Ph.D., 1961). I have more than 40 years of professional expertise as a physician-specialist in occupational and environmental medicine, medical school teacher and active researcher. I have spent approximately half of my career in government-sponsored institutions and academia. The other half was consumed by building up and managing a research department with 70 scientists that was sponsored by the automobile industry. Presently, I am a private consultant specialized in environmental health assessment practice.

The comments that I offer are based on my experience as a scientist concerned primarily with mechanisms by which airborne pollutants can exert an adverse effect on public health and on the assessment of their potency for having an impact on public health. As early as 1969, I was invited

to serve as a member of the National Academy of Sciences/National Research Council Committee on Biological Effects of Air Pollution and the Chairman of the Panel that prepared the first NAS/NRC protype of today's criteria documents. As an observer and reviewer, I have been involved in the preparation of ozone criteria documents since the early 1970's and actively involved in discussions of the EPA's Science Advisory Board and CASAC Committee on the most recent update of these documents. My abbreviated biographical summary is appended to these comments.

My professional opinion on the past, present and proposed ozone standards was shaped by consideration of the scientific basis that has been and is presently offered as a rationale for the U.S.Environmental Protection Agency proposed decision of November 27, 1996 to revise the National Ambient Air Quality Standard (NAAQS) for Ozone. I have already offered my comments in the meetings of the Clean Air Advisory Committee or public hearings but I am still deeply concerned about the U.S. EPA intention to replace the current 1-hr. primary standard (last modified in 1979) by lowering the level from 0.12 ppm to 0.08 ppm ozone with 8-hour averages based on the assumption that this action will provide an "increased protection for children and asthmatics".

The primary reason of my concerns is the fact that this revision of the ozone standard has been prematurely closed by the linkage of the ozone standard to the review of the National Ambient Air Quality Standard (NAAQS) for Particulate Matter. Unfortunately, the particulate standard is under court-imposed deadlines and permits no further time to better clarify our understanding of the action of low-level ambient ozone concentrations on public health.

Because the U.S. EPA criteria documents should "accurately reflect the latest scientific knowledge useful in indicating the kind and extent of all identifiable effects on public health or welfare which may be expected from the presence of (a) pollutant in the ambient air … " (Section 108 of the Clean Air Act, emphasis added), it is difficult to accept that the proposed linkage to the particulate matter and premature closure of the standard review can prevent the incorporation of

all what is known about the health effects of ozone into the documents. It is important to note that the ozone criteria document concedes that in many areas the assumed action of ambient ozone has been established on the basis of mechanisms that are more predicted than fully explained, and that more investigations are needed before we fully understand the public health risks of ambient ozone. As a result, the U.S. EPA Administrator is forced to promulgate revised standards on a scientific basis that does not accurately reflect the current scientific knowledge or permits further updates after the closure of the document.

Primarily I am talking about a set of research data that have been produced by U.S. EPA research centers already in 1994, presented in a large scientific meeting in 1995 but not yet published in a peer-reviewed literature and therefore, not included into the criteria document. This occurs in spite of the fact that the results of new investigations substantially modify interpretation of many ozone effects on which the rationale of the newly proposed standard stands.

Indeed, these results profoundly change the interpretation of one of the quantitative indices of ozone action that has been used in numerous - if not all - studies that quantify and assess the most important of the alleged ozone actions, i.e. the effect on the vital function of the lung. The action of ambient ozone is believed to be responsible for "acute changes in lung function, structure and metabolism" (emphasis added, U.S. EPA criteria document, 1996) that have been up to now documented by statistical declines in one of the pulmonary function tests (forced expiratory volume in one second, FEV_1).

This method has been widely used for quantitative assessment of public health impact of ambient ozone based on the assumption that the observed FEV_1 declines reflect cellular injury and edema of sensitive cells in deep respiratory airways and by that, compromise the vital functions of the respiratory system. New research data produced, but not yet published, by the U.S. Environmental Protection Agency show now that our assumptions were incorrect. New data demonstrate that the observed declines are not caused by an injury but merely represent a reflex response of the nervous system mediated by stimulation of sensitive receptors that are ubiquitously present in the

respiratory airways (Passanante et al., 1995). By the reflex response to this stimulation, the tested person does not take enough air into his or her lung (maximum inspirium) that is necessary for the correct performance of the test. When the reflex response is removed by anesthetizing the sensitive receptors, no ozone-induced declines in the forced expiratory volume test are observed. Because the anesthesia cannot remove existing cellular injury, this reversal of the test performance documents that no ozone-induced damage exists in the respiratory airways. The test describes only a deficit in the performance of the test and signals no changes in the actual lung function. In this respect, the reflex response has beneficial character and the sensitive receptors protect pulmonary airways similarly as the constriction of pupils in the eye protects the retina against adverse effects of intensive light.

The study (Passannante et al., 1995) was motivated by the observation that subjects with the largest spirometric declines invariably complain of pain on deep inspiration (Folinsbee et al., 1988) and that even very low pain stimuli may reflect the individual's inability or unwillingness to take a full inspiration due to irritation of sensitive receptors (C-fibers - Hazucha et al., 1989). In the test, healthy ozone responders were exposed to ozone (0.4 ppm) or air for two hours with intermittent exercise. Spirometry (FEV_1) was done pre-and post-exposure. The subjects were then administered a low dose of a pain-killing analgesic (sufentanil citrate, 0.2 µg/kg BW) and the lung function tests were repeated within five minutes. Table 1 shows the results of these tests. It can be easily noted that ozone produces significant declines in the performance of the test that are not removed when saline is administered. In contrast, a low dose of analgesic immediately restores the full pulmonary function. The recovery is complete in males and nearly complete in females. The study concludes that low-level analgesia rapidly reverses the symptomatic and spirometric effects of ozone inhalation and the results confirm that neural receptors play a key role in modulating ozone-induced inhibition of inspiration (Passanante et al., 1995). The observations reaffirm previous suggestions that ozone inhalation stimulates tracheal and laryngeal receptors which lead to an involuntary inhibition of full inspiration, a reduction in vital capacity and a concomitant decrease in maximal expiratory flow rate in humans (Hazucha et al., 1989).

This is not a new discovery. This interpretation of the declined pulmonary function tests was proposed by ozone investigators already in 1972 but the final proof of this mechanism was provided only by these new investigations. More importantly, because the FEV_1 test has been used as the most sensitive index of ambient ozone action, these observations substantially modify the adversity of low-level ozone action used in the proposed decision in support of the standard revisions. It would be highly unfortunate if court deadlines imposed on the compliance with the Clean Air Act would not permit the inclusion of this latest and accurate knowledge into the proposed decision. Otherwise, the document will only prolong an incorrect interpretation of the test significance and result in controls that will not produce the expected benefits.

It can be argued, that research approaches other than FEV_1 still demonstrate measurable responses to inhaled ozone, such as detectable presence of increased counts of "inflammatory" cells in the airways or increased hospital or emergency room admissions for asthma, etc., even at low ozone levels. However, these changes are marginal, not specific for ozone and represent more "physiological changes of unknown clinical significance" (ATS, 1985) rather that an adverse effect in the context of the Clean Air Act. Surprisingly, neither the asthmatics nor patients with chronic obstructive pulmonary disease are more sensitive to ozone than the healthy population. Even though the changes have been statistically associated with ozone pollution, the causal role of ozone has not yet been verified because of the presence of other pollutants and confounding factors. The causal role of ozone must be better established before we accept that ozone alone is responsible for these findings.

On the other hand, the correct interpretation example of the real FEV_1 significance more than adequately demonstrates that the clarification of the low-level ozone action needs to be completed before the knowledge is used for regulatory decisions. This process cannot be dictated by administrative deadlines of the Clean Air Act. I urge Congress to require that the U.S. EPA Administrator take more time for final clarification of numerous open questions concerning the ozone action on public health. The U.S. EPA should be compelled to accelerate the completion of the project and its publication in the peer-reviewed scientific journals so that the information

is incorporated into the criteria document and serves as a basis for the reevaluation of the proposed decision. This should occur before the incorrect information is used for regulatory actions that could waste important resources and provide no societal benefits.

References:

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Table 1 Sufentanil Analgesia Reverses Spirometric Effects of Ozone Inhalation (data from Passannante et al., 1995)

	Pre-Exp. FEV_1 (L)	Post-Exp. FEV_1 (L)	Post-Drug FEV_1 (L)	Pre-Exp. FEV_1 (L)	Post-FEV_1 (L)	Post-Drug FEV_1 (L)
	Air - Saline			Air - Sufentanil		
Females (n = 3)	3.2	3.2	3.2	3.2	3.2	3.3
Males (n = 4)	4.2	4.0	4.2	4.2	4.2	4.3
	Ozone - Saline			Ozone - Sufentanil		
Females (n = 11)	3.3	2.4	2.4	3.2	2.3	2.9
Males (n = 9)	4.7	3.3	3.5	4.7	3.4	4.3

BIOGRAPHY

Dr. Jaroslav J. Vostal, M.D./Ph.D. is Principal and Sr. Medical Consultant of the Environmental Health Assessment Consultants, Int. at Bloomfield Hills, Michigan, a position held since July 1, 1993.
Prior to this position, Dr. J.J. Vostal served between 1974 to 1983 as the Department Head of the Biomedical Sciences Department of the General Motors Research Laboratories at Warren, Michigan. The department has been primarily studying health effect of air pollutants that are associated with the use of motor vehicles and problems of automobile crashworthiness and safety. In this position, Dr. Vostal provided leadership in building up an independent laboratory that conducted animal as well as human volunteers or epidemiology studies on various air pollutants starting with carbon monoxide and ozone up to the fine particles of Diesel exhaust. For this purpose, Dr. Vostal and his department built a high-standard laboratory with innovative concepts of exposure technologies that permitted long-term animal exposures with capacity up to 2000 laboratory animals and large-volume human exposure facilities. In addition, Dr. Vostal was responsible for large extramural programs in health effects of air pollutants. In 1983, he became Sr. Medical Research Advisor in the Executive Staff of the Laboratories and in 1989 he transferred as Sr. Medical Consultant to General Motors Environmental Activities where he remained until the time of his retirement in January, 1993.

Before joining the General Motors Research Laboratories, Dr. Vostal was Associate Professor of Pharmacology and Toxicology and of Preventive Medicine and Community Health at the University of Rochester Medical School where he participated in the University Environmental Health Center activities n toxicology of heavy metals, primarily mercury, cadmium and lead. Prior to his appointment at Rochester, Dr. Vostal was Visiting Scientist at the Karolinska Institute at Stockholm and researcher at the Institute of Industrial Hygiene and Occupational Diseases of the Ministry of Health in Czechoslovakia. He received his medical degree from Charles University at Prague and his Ph.D. degree in occupational and environmental medicine from the National Academy of Sciences of the Czech Republic.

Dr. Vostal has served in an advisory role to numerous public organizations and committees. Between 1970 to 1973, he was member of the National Academy of Science/National Research Council Committee on Biological Effects of Air Pollutants. In 1970, he was appointed Chairman of the BEAP Panel on Fluorides and was responsible for the preparation of the first publication on this subject. Dr Vostal served also repeatedly as consultant to the U.S. Department of Justice, Food and Drug Administration, National Institute on Occupational Safety and Health and the U.S. Environmental Protection Agency. As a member of the Permanent Commission and International Association on Occupational Health, he organized the first international meeting on Maximum Allowable Concentrations in Industry in 1959, participated in the Task Group on Metal Accumulation meeting in 1972, on Dose/Response Relationships of Toxic Metals in 1974, on Factors influencing the Susceptibility to Metal Toxicity in 1977, WHO Task Group on Carbon Monoxide in 1977, Karolinska Institute Symposia on Biological Tests in the Evaluation of Mutagenicity and Carcinogenicity of Air Pollutants in 1982 and on Risk Assessment of Urban Air in 1992. In 1983, Dr. Vostal was appointed as expert on the New Etiology of Lung Cancer within the U.S.-Japan Cooperative Program in Medical Sciences.

Dr. Vostal has been active in numerous professional organizations such as American Medical Association's Council on Scientific Affair, New York Academy of Medicine, Academy of Toxicological Sciences, Society of Toxicology and the Air & Waste Management Association where he continues to serve as the Coordinator

of the Air Group of the A&WMA Technical Council.